



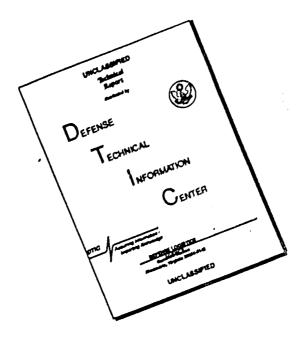
Technical Report N-60 September 1982

Integrated Installation Noise Contour System

ACOUSTIC DIRECTIVITY PATTERNS FOR ARMY WEAPONS: SUPPLEMENT 1

70 AD A 12 166 Paul D. Schomer NOV 2 2 1982 11 22 110 82 Approved for public release; distribution unlimited

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St. ASSTRACT (Continue on reverse side if responsely and identify by block number)

(This report gives the acoustic directivity patterns for the LAW and TOW antitank weapons and three routinely used weapon simulators. These data supplement the directivity pattern data measured and analyzed by the U.S. Army Construction Engineering Research Laboratory (CERL) for other weapons in the Army inventory, as reported in CERL Technical Report N-60 (January 1981). These supplemental data have been included in the CERL-developed Integrated Noise Contour System (INCS) and its associated blast-noise prediction computer program, BNOISE 3.2. The Army Environmental Hygiene Agency (AEHA) uses CERL's INCS/BNOISE 3.2 prediction program to help installations implement the Army's Installation Compatible-Use Noise Zone Program (ICUZ).

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#### FOREWORD

This research was conducted for the Directorate of Military Programs, Office of the Chief of Engineers (OCE), under Project 4A762720A896, "Environmental Quality Technology"; Task A, "Installation Environmental Management Strategy"; Work Unit 011, "Integrated Installation Noise Contour System." The OCE Technical Monitor was Mr. Gordon Velasco, DAEN-MPE-1.

The work was performed by the Environmental Division (EN) of the U.S. Army Construction Engineering Research Laboratory (CERL). Dr. R. K. Jain is Chief of CERL-EN

COL Louis J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

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# ACOUSTIC DIRECTIVITY PATTERNS FOR ARMY WEAPONS: SUPPLEMENT 1

# 1 INTRODUCTION

# **Background**

On 20 May 1981, the Army instituted the Installation Compatible-Use Noise Zone Program (ICUZ). Under ICUZ, Army installations will work with the local civilian community to find ways to prevent or lessen the encroachment of off-installation housing and other noise-sensitive land uses into areas that are, or are likely to be, impacted by Army training noise.

V tal to the success of the ICUZ program is a noiseprediction computer tool developed by the U.S. Army Construction Engineering Research Laboratory (CERL). The Integrated Noise Contour System (INCS) creates distance-scaled noise contours using data on the type, frequency, and time of training operations; weapon types and charge sizes; and target and firing point locations. These contours, when overlayed on a map of an installation and its environs, identify existing or potential conflicts between noise levels produced by training operations and noise-sensitive land uses on or near an installation. Using BNOISE 3.2, the blast noise prediction computer program associated with INCS, contours also can be created that predict how changes in training range operations, siting, use intensity, and weapon types will alter an installation's noise-impact profile.2 The Army Environmental Hygiene Agency (AEHA) can make noise predictions for any Army installation using CERL's INCS/BNOISE 3.2 program.

One important data type needed for INCS/BNOISE 3.2 is the individual acoustic directivity pattern associated with most impulse-noise producing weapons in the Army inventory. These patterns form a standard module of data for the INCS/BNOISE 3.2 prediction program.

CERL Technical Report N-60 lists directivity pattern data obtained during tests at Fort Sill, OK, for many weapons used routinely in Army training (Table 1).3 This

supplement to that report contains directivity pattern data for the LAW and TOW antitank weapons and three regularly used weapon simulators.

#### **Purpose**

The purpose of this study was to determine the acoustic directivity patterns of the LAW and TOW antitank weapons and three regularly used, impulse-noise producing weapon simulators.

## Approach

Noise measurements were made on the LAW and TOW antitank weapons and on three flash and boom simulators at Fort Carson, CO. The measurement method was basically the same as that described in CERL Technical Report N-60. Weapon firings were interspersed with detonations of C-4 plastic explosive. The C-4 was used to "calibrate" the site and allow data to be corrected for wind and terrain effects.

# **Mode of Technology Transfer**

The directivity patterns obtained as a result of this study have been added to the INCS/BNOISE 3.2 input data bank and are available for use by AEHA and all Department of Defense activities.

Table 1
Weapons Tested (Fort Sill, OK)

Weapon Name	Modei
8-in. self-propelled	MIIQAI
105-mm tank	M60
4.2-in. mortar	M50
8'-mm mortar	••
106-mm recoilless rifles	M40A1
90-mm recoilless rifles	M67
105-mm howitzer	M102
155-mm howitzer	M109
8-in. howitzer	Mi10
152-mm Sheridan (tank gun)	M551
155-mm howitzer	MIII
155-mm howitzer	M109A1

# 2 DATA COLLECTION

Measurements were performed at Fort Carson, CO. The antitank weapon data source was the normal training operations of an armor combat support company. The simulators were activated especially for the CERL measurements. The test site was an open grassy field, the standard type of training range at Fort Carson. An abbreviated test plan is given in Appendix A.

# **Test Sequence**

Table 2 lists the two weapons and three simulators measured for blast noise during the Fort Carson test. The

<sup>&</sup>lt;sup>1</sup>Paul Schomer, "Noise Impact Prediction and Control," Military Engineer, Volume 74, Number 479 (April 1982).

Paul D. Schomer et al., Blast Noise Prediction Volume I: Data Bases and Computational Procedures, and Lincoln M. Little et al., Volume II: BNOISE 3.2 Computer Program Description and Program Listing, Technical Report N-98/ADA089440 and ADA 09835 (U.S. Army Construction Engineering Research Laboratory [CERL], March 1981).

P. D. Schomer, L. M. Little, and A. B. Hunt, Acoustic Directority Patterns for Army Weapons, Technical Report N-68/ADA66623 (CERL, January 1979).

Table 2
Weapons Tested and Event Numbers
(Fort Carson, CO)

27 Marc	h 1961	2 /	April 1961	5 Apri	1 1961
Event No.	Weapon	Event No.	Weapon	Event No.	Weapon
1	C-4	1	C-4	21	C-4
2	TOW	2	C-4	22	C-4
3	TOW	3-7	Artillery simulator	23	LAW
4	C-4	8	C-4	24	LAW
5	TOW	9	C-4	25	LAW
6	TOW	10-14	Hand grenade simulator	26	C-4
7	C-4	15	C-4	27	C-4
8	C-4	16-18	Artillery flash simulator		
		19	C-4	28	LAW
		20	C-4	29	LAW
				30	LAW
				31	C-4
				32	C-4

main body of the test used C-4 plastic explosive as an omnidirectional calibration source. The test sequence consisted of one blast of C-4 followed by one or more events from the weapon or device under test. The C-4 sound-pressure level contours were used to correct for the effects of wind and/or terrain. This is essentially the same procedure used during the original Fort Sill measurements.

## **Measurement Apparatus**

Each weapon or simulator was measured separately. For each measurement series, microphones were deployed in a concentric ring. A radius of about 600 ft (183 m) was used for the antitank weapon measurements, and a radius of 250 ft (75 m) was used for the simulator devices. Each test-series ring consisted of six microphones placed at 60° intervals around the firing point, as shown in Figure 1.

The microphones were Endevco piezoresistive transducers close-coupled to CERL-built preamplifiers and line drivers. (Appendix B describes the Endevco device and the CERL preamplifiers.) Each microphone was wired to the CERL mobile field acoustics laboratory, where the signal was recorded on an Ampex PR 2230 14-channel FM recorder. For comparison, a standard B&K-type 4921 outdoor microphone system was located at Station 7, wired to the CERL van, and its signal recorded. However, the peak levels registered by the B&K 4921 system were "clipped," because they were larger than the maximum level capability of the B&K 4921.

During the test, the measurement plan (Appendix A) had to be modified because the simulators and the LAW rocket produced too little noise to be measured at 600 ft (182 m). So, the test radius was changed to 250 ft (72 m). The size of the C-4 calibration was reduced from 5 to 1-1. 1b (2.2 to 0.5 kg).

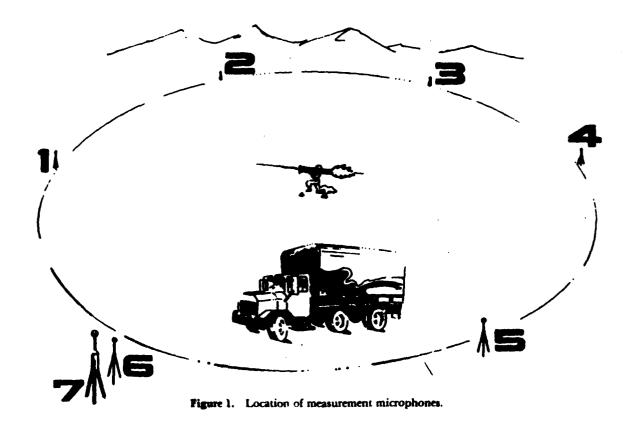
#### Callbration

Calibration was performed (1) at the beginning of every new tape, (2) at the end of each tape and/or day, (3) when changes were made in the equipment or equipment placement, (4) when the equipment was first set up, and (5) when any equipment malfunction was suspected. The six Endevco stations were calibrated with a Blck 4220 piston-phone. CERL made special housings for the Endevco microphones so the calibration could be done using standard laboratory and field devices (see Appendix B). At the beginning of each FM tape, the calibration tone was recorded for about 15 seconds at the measurement tape speed of 60 in./second (1524 mm/second). The Blck 4921 system was calibrated initially using the Blck-type 4220 pistonphone. Subsequent calibrations were performed using its internal 1000-Hz electrostatic actuator.

# 3 DATA REDUCTION

Primary data reduction was done using the CERL-developed True-Integrating Environmental Noise Monitor and Sound-Exposure Level Meter. This data reduction resulted in a measure of the flat-weighted and C-weighted sound exposure level (FSEL and CSEL). The Norland computing oscilloscope was used to measure flat-weighted and C-weighted peak data for each event. Background noise measurements were also made to ensure that the recorded data were far enough above the noise level to be valid. Appendix C lists analyzed data by event.

<sup>&#</sup>x27;Aaron Averbuch, et al., True-Integrating Environmental Noise Mentter and Sound-Enpayure Lovel Meter Volumes I through IV, Technical Report N-41/ADA66000, ADA66000, ADA66000, and ADA66000 (CERL, May 1970 June 1979, and March 1980).



Each data event or series of even's was first corrected by the adjacent (in-time) C-4 calibration events. A set of numbers was found for the C-4 events just before and after the weapon or device event(s) and used to correct the C-4 data to an omnidirectional, hemispherical (actually circular in the ground plane) radiating source. The event data were averaged by microphone and corrected by the set of numbers found to convert the C-4 to a perfect circular source. These averages are listed in Appendix D. Similar weapons or sources (after correction by adjacent C-4 calibrations) were then combined (energy-averaged by microphone) to form the overall weapon or device directivity pattern. Corrections were made to form a symmetrical pattern. Appendix D lists the resultant data by weapon or device.

Table 5 lists the data as they are included in the BNOISE 5.2 weapons input table. Table 5 is based on the data given in Appendix D. In the table, data for the simulators are adjusted so they are relative to 5 lb (2.2 kg) of C-4 on the ground (as required by BNOISE 3.2), rather than the 1-1/4 lb (0.5 kg) used in the test. A conversion factor of 5 decibels (dB) was used. The reference distance was 250 m. At this distance, 5 lb (2.2 kg) of C-4 exploded on the ground typically produces a CSEL of 119 dB.

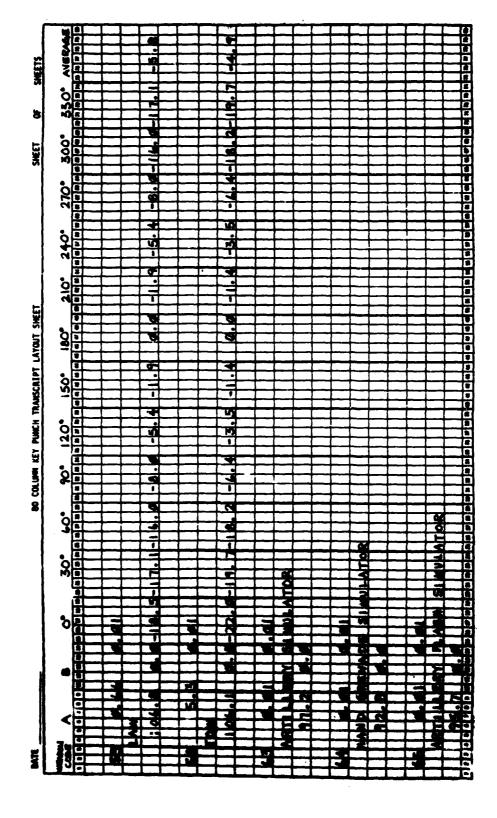
# 4 CONCLUSIONS

The report gives the acoustic directivity patterns for the LAW and TOW antitank weapons and three routinely used weapon simulators measured at Fort Carson, CO. These data supplement the pattern data presented in CERL Technical Report N-60. These supplemental pattern data will be included in the weapon directivity pattern load module of BNOISE 3.2 and made available to users of the CERL-developed INCS.

The onsite need to vary the original test plan indicates some of the problems in attempting to specify standard measurements for the directivity pattern of Army weapons. Some of the devices were such that the planned measurement distance had to be reduced from 600 to 250 ft (182 to 76 m). The C-4 calibration charge also had to be reduced from four sticks to 1 stick (i.e., from 5 to 1-1/4 lb [2.2 to 0.5 kg]). Standard measurement procedures cannot be developed without showing sufficient repressibility over time (the same weapon measured in the same place but at different times), repentability over position (the same weapon measured in different locations at different times), and until enough is known about each type of weapon to adequately specify measurement distances stall calibration charge size.

<sup>\*</sup>Paul D. Schomer, et al., Blast Noise Prediction Volume I: Data Bases and Computational Procedures, Technical Report N-98/ADA609440 (CERL, March 1981).

Table 3 Reduced Data by Weapon or Device



## APPENDIX A: TEST PLAN FOR ROCKET NOISE MEASUREMENTS

#### **Beskground**

A ! ckground literature study was performed on the sources and levels of noise generated by rockets. This study indicates that very little far-field data exist on rocket noise emissions other than for the very large ballistic-missile types of rockets. For the small rockets, interest has centered primarily on the noise encountered at the operator's ear. For preliminary work, the Army Environmental Hygiene Agency (AEHA) has equated the pounds of propellant to the far-field pressure in a like manner to explosions of C-4 plastic explosive or TNT. Indeed, some recent work in the United Kingdom by Clayden, Walters, and Hillman supports this concept. They say, "... in the near field, the shock strength depends strongly on the detailed mechanism of the starting process, hence there is some scope for noise reduction, but in the far field it is primarily dependent on the total energy released." Basically, the small rockets appear to produce most of their noise from the bursting of a plug or membrane when the engine ignites and from the subsequent shock wave formed by the engine burn. However, the small amount of data which do exist indicate a fairly extreme directivity pattern for the noise emissions from small rockets.

To test the preliminary hypothesis that the primary noise of interest was the burst which comes at or just after ignition of the rocket engine, simple measurements were performed on a DRAGON missile at Fort Benning, GA. Typical recorded waveforms are shown in Figure A1. These waveforms are classical shock wave signatures, identical to those generated by explosives. Thus, the literature search and the preliminary measurements at Fort Benning show that (1) small rockets can be modeled identically to other impulsive weapon systems such as armor or artillery and (2) the detailed directivity pattern of each weapon must be measured similarly to those already reported in CERL Technical Report N-60 for most armor and artillery weapon systems.

#### Purpose

The purpose of these measurements is to gather required data on the noise emissions of small Army rockets. These rockets are characterized by a plug or seal at the motor end which bursts or explodes shortly after ignition. The primary noise to be measured by these tests is that of the burstin rexplosion of this plug or membrane and the subsequent shock wave formed by the engine burn.

# Weapons To Be Messured

- I. Primary Weapons
  - a. LAW
  - b. Improved LAW (VIPER)
  - c. TOW
  - d. DRAGON.

## 2. Second Priority

- a. STINGER anti-aircraft missile system
- b. Redeye
- c. 2.75-in. rocket.

#### 3. Airborne Rockets

- a. Hellfire (Helicopter Launch to Antitank Missile System)
- b. M65 (Antitank missile)
- c. SS-11 missile.

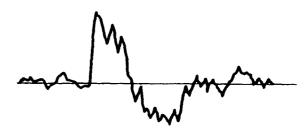


Figure A1. DRAGON missile waveforms (about 100 m to the rear; FM recording).

#### Test Location(s)

It is desired to make these tests as part of regularly scheduled training or other tests rather than create a special set of tests just for these measurements. Thus, the measurement team will move from site to site at various times in order to accomplish these measurements. To the extent possible, however, it is clearly desirable to measure more than one rocket at the same location in approximately the same timeframe. For proper data, the test site must be a clear, level, open area.

### **Test Setup**

Measurements will be done like those already employed for the directivity patterns of armor and artillery weapons. Specifically, measurements will be made on a ring having a radius of 250 m. Additional measurements will also be made at distances of 500 m, and at one site, to the rear of the rocket at 1000 m. The measurement sites are shown in Figure A2. Most of these sites will be wired by landline to

<sup>\*</sup>W. A. Clayden, A. G. Walters, A. Hillman, "A Survey of UK Work on Noise and Blowback From Man-Portable Anti-Tank Weapons," paper presented at the TTCPW2 Symposium on In-Bore Dynamics and Intermediate Ballistics, July 7 and 8, 1976, Mon'rey, CA.

CERL's instrument van, where FM recordings will be made of the noise signatures. The other sites will be manned and will use Nagra recorders and a special, CERLdeveloped modulation system.

As with the heavy weapons measurements, 5 lb (2.2 kg) of C-4 set plastic explosive on a post about 3 ft (0.9 m) high will be used to calibrate the measurement site and relate these new measurements to previous weapons measurements and previous sound propagation work by CERL. These C-4 calibration charges are the only requirement CERL has which may in any way affect the conduct or order of other training or tests.

Approximately 5 to 10 measurements are required for each rocket-engine combination.

# **Support Requirements**

CERL will do all the measurements and data analysis. The acoustical data will be gathered by CERL personnel using CERL equipment. In addition to firing the rocket-weapon system, the facility involved will have to supply about one to two personnel trained in demolition to set the C-4 explosive charges and will also be responsible for safety requirements for use of the weapons and for the C-4.

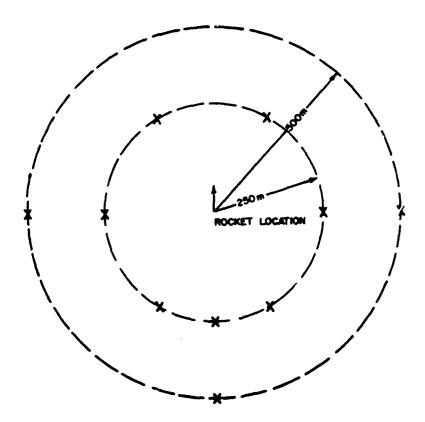


Figure A2. Proposed measurement locations.

# APPENDIX B: TEST EQUIPMENT SPECIFICATIONS AND WIRING DIAGRAMS

Table Bl Microphone Line Driver Parts List

RI.	1	R.	5													 											9	ю	ĸ.	. 1	%		
R2,	1	R	11	D.			. ,									 											,	0	01	٤.	19	6	
R3																											ì	, 8	IN	1.	59	6	
R4																 											3	0	01	ί.	19	6	
R6																 											ı	A	4.	39	ţ.		
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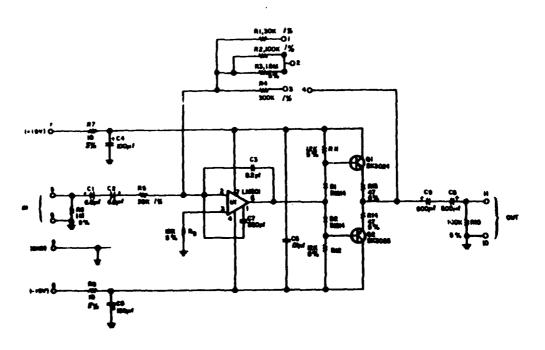


Figure B1. Microphone line driver schematic.

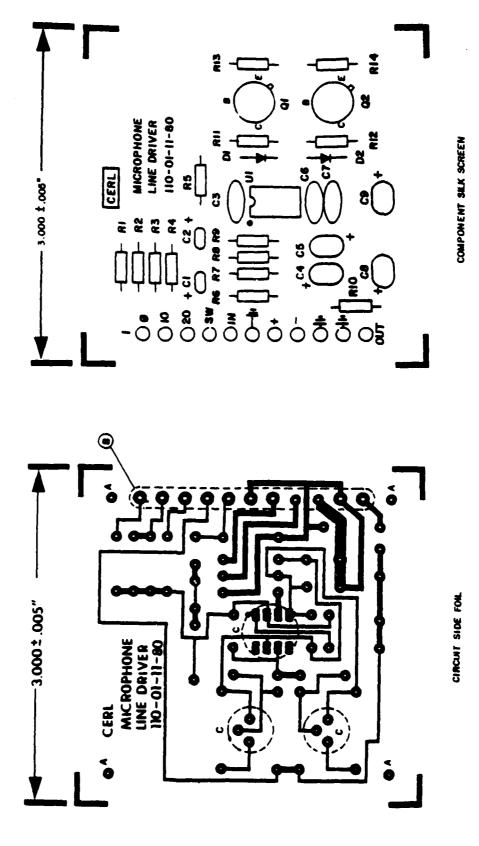


Figure B2. Microphone line driver printed circuit board.

Table B2
Piezoresistive Microphone Presmplifier Parts List

			Maximum Sound-Pressure
Gain Desired	R <sub>1</sub>	c,	Level
0	Short	30 pf per ceramic disk	190
20	8.1k Ω	20 pf per ceramic disk	170
30	27.6k Ω	10 pf per ceramic disk	160
50	284k N	5 pf per ceramic disk	140

# Piezoresistive Microphone Preamp

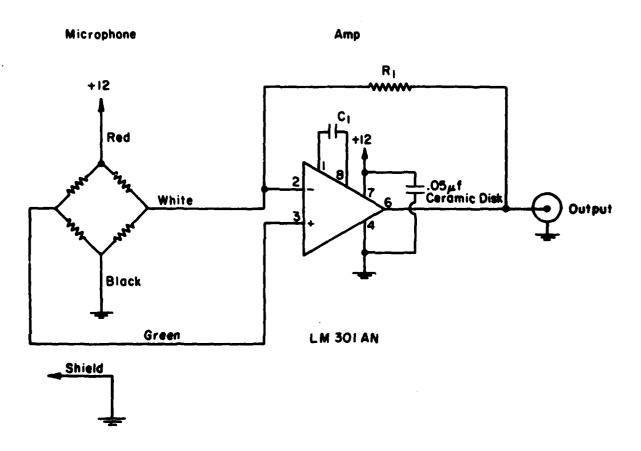


Figure B3. Piezoresistive microphone preamplifier.

# SPECIFICATIONS FOR MODEL SSSM1 MICROPHONE (According to ANSI and ISA Standards)

#### PERFORMANCE

RANGE

SENSITIVITY (AT 15 Vdc)

**RESONANCE FREQUENCY** 

FREQUENCY RESPONSE

AMPLITUDE LINEARITY VIBRATION SENSITIVITY

WARMUP TIME

BURST PRESSURE

At least 100 to 180 dB SPL

-110  $\pm 3$  dB ref 1 V per  $\mu$ ber (equivelent to 63 rms mV at 160 dB

SPL or 218 mV/pei)1

45 000 Hz, typical

Within ±1 d8 to 5 000 Hz

Within 23 dB to more than 10 000 Hz

20.5 dB, 100 to 190 dB SPL

100 dB SPL at 1 pk g, typical

<30 sec.

>20 pei

#### ELECTRICAL

SUPPLY VOLTAGE

MAXIMUM SUPPLY VOLTAGE

**ELECTRICAL CONFIGURATION** 

POLARITY

RESISTANCE

15 Vdc

18 Vde

Four-active-arm piecoresistive bridge in silicon

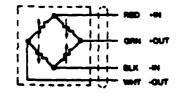
Positive autput for increasing pressure

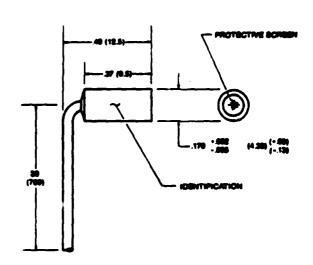
1 800  $\Omega$ , typical 1 600  $\Omega$ , typical 100 MR minimum at 80 Vdc, leads to case, leads to shield and

1 Relations 8 cB - 8000 rms jubar (rms dynastics/) - 30 s. 10-1 forer rms - 30 julis rms

Figure B4. Microphone specifications.

## SPECIFICATIONS FOR MODEL SSSM1 MICROPHONE





## STANDARD TOLERANCE

## MECHANICAL

MOUNTING

MATERIAL EXPOSED TO MEASURAND MEDIA

CABLE

WEIGHT (EXCLUDING CABLE)

# Adherive Bonding (RTV recommended)

Stainless steel, Parylane C and epoxy

Integral, four conductor, shielded, Tellion-insulated conductors, gray PVC jacket, 30 in. (760 mm) long, .05 in. (1.3 mm) dis.

0.038 oz (0.8 g), cable weight 0.038 ce/ft (3.4 g/m)

# ENVINORMENTAL

TEMPERATURE RANGE COMPENSATED MAXIMUM

VIERATION

SHOCK

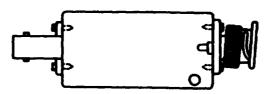
HUMBITY, PER MIL-STD-6085, Method 1085, test, condition 8 4°F to +212°F (-40°C to +100°C) -46°F to +225°F (-44°C to +107°C)

500 g pk, pinysoldel

10 000 g. 100 ps helf-sine

lociation resistance 100 MS at 50 Vds

Figure B4. (Cont'd).



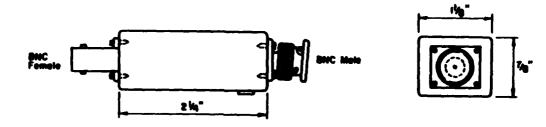


Figure 25. Piezoresistive preamp encasement.

# APPENDIX C: ANALYZED DATA (BY EVENT)

Stadous													
				1				1				3	
Eve. 14	Weepen	Peak (Flat)	dis (Sec)	PSEL/ Noise	CBEL/ Noine	Penk (Fint)	dB (Ser)	PREL/ Noise	CREL/ Nates	Peak (Fint)	dis (Sec)	POEL/ Notes	CREL/ Noise
				128.6	122.1			129.5	129.3			130.4	125.6
1	C-4	146.4	-11.6	104.2	101.6	148.2	-11.9	104.1	101.5	151 6	-11.5	101.3	98.5
												112.5	110.0
2	10W									135.2	-12.0	97.1	94.5
								101.0	96,0			111.6	112.9
3	IOW					122.7	- 10.9	99.4	602.6	136.5	-12.0	91.9	<b>68.2</b>
				130.3	125.1			127 6	122.9			128.5	123.7
4	C4	150.7	-11.6	104.7	102.3	148.5	-12.4	105.2	102.8	146.5	-12.0	101.1	90.8
								109.5	<b>99.</b> 5			110.9	160.5
5	TOW					125.6	-10.8	87.6	85.4	135.5	-12.0	99.4	<b>86</b> .1
				125.3	121.0			102.5	95.5			113.9	111.9
6	TOW	146.3	-10.5	100.9	100.6	120.3	-10.8	86.5	85.2	157.7	-12.0	92.6	₩.7
				129.5	125.5			127.4	122.5			136.6	124.5
7	C-4	147.9	-11.4	105.8	102.8	147.7	-11.8	104.9	102.6	1465	-12.0	101.9	<b>9</b> .5
•		.,,	***	128.9	123.9			128.9	123.5			129.3	125.5
	C4	148.7	-11.4	105.6	103.7	147.8	-11.8	165.5	102.9	150.8	-12.0	101.7	100.5
•	M	198.7	-11.4	145.0	143.7	147.0	-11.8	149.3	142.7	139.4	-12.0	101.7	

		4				5				•				DATE: 7	27 MARCH
Peak (Flat)	dB (Sec)	FREL Noise	(SEL Notes	Prob (Flat)	dill (Sec)	PSEL Notes	CSEL/ Noine	Peak (Flat)	dia (Rec)	PSEL/ Note:	(SEL) Noise	Peak (Flat)	dig (Brc)	PSEL/ Noise	(SEL Notes
						132.1	1×A.B					116.5	-13.2	124.6 162.5	120.6 (40.0
				,	-12.0	119.1	98.1					1 8.0	- ****		••••
		115.0	114.2		-11.5	101.7	95.8			101.9 96.4	101.3 91.7				
140.9		96.5 196.2	96.5 122.2	148.5		130.7	96.6 127.1 98.4		-11.7	192.1 197.8	190.2 190.1	147.0	-12.7	126.6 106.3	122.7 101.3
146.6	-12.0	104.5	165.4		-11.5	110.2	117.2		-11.4	165.1 91.0	100.3	*****			•
					-11.6	98.4 119.9 98.6	119.3		-11.4	10L3 98.7	100.5				
		186.9	122.0		-11.6	151.5	127.8		-12.0	101.3	180.7 97.7	140.5	-12.7	126.0 166.5	1863 1863
	-12.0	187.1	160.7 160.5		-12.1	192.5	1391			191.4	167.9			194.1	166.3 166.3
140.5	-124	100.7	102.4	136.6	-12.2	94.5	98.9	135.0	-16.0	102.1	10.5	HES	-42.7		751-0

:testion	E.					1									
										2				3	
Event		Weaper	•	Peak (Plat)	dB (Bec)	PAEL/ Noise	Noise	Peak (Fint)	(Sec)	POEL/ Noise	CSEL/ Noise	Penk (Flet)	dB (Sec)	Noise	CSEL/ Noise
						129.9	122.5			127.9	124.9			129.1	126.6
1		C-4		152.3	-13.1	90.9	<b>97</b> .1	153.4	-12.7	104.6	102.4	151.5	-12.2	106.9	101.7
						i 19.4	126.6			129.1	126.5			129.7	127.4
2		C4		151.3	~13.1	1 4.8	101.6	151.6	-12.7	101.6	99.0	152.1	-12.3	101.5	99.5
		Artiller				111.4	110.1			114.6	113.9			115.9	115.4
3		Simulute		136.5	-14.2	92.6	95.0	140.1	-12.6	95.8	94.2	141.5	-12.3	96.6	95.4
		Aruller				100.1	106,1			118.2	116.2			112.7	115.4
4		Simulate	•	132.1	-14.2	94.6	90.3	142.5	-13.5	61.2		136.0	-12.4	96.6	M6.5
		Artiller				105.5	103 6			106.5	105.2				102.5
5		Simulati	•	130.4	-14.2	145.4	#0.6	133.5	-13.4	79.8	78.9	129.7	-12.1		78.6
-								,,,,,	•=-•						
6		Artiller Simulut	•	131.0	-14.2	167.4 84.9	105.7 02.2	130.5	-13.4	106.8 61.4	104.9 79.1	151.7	-12.4	110.0 82.6	1 <b>49.5</b> 79.4
•				131.0	- 1 1.2			120.3	-13.4			1,51.7	- 16.		
		Artiller		141.4		106.1	106.9			107.4	106.1			100.4	145.6
7		Simulati	×	131.2	-14.2	84.8	81.9	132.1	-13.4	90.2	72.4	194.8	-12.4	83.9	<b>49</b> .1
						129.6	127.0			127.7				129.5	127 4
Ħ		(4		152.4	-13.4	104.7	102.3	150.7	-13.4	102.4	96.9	152.5	-12.4	100.7	<b>56</b> 7
						129.0	127.0			1 <b>29</b> . i	126.4			129.9	127 A
•		G4		152.7	-13.4	195.4	1 <b>03</b> . l	152 1	-13.4	101.3	96.7	154.1	-12.4	105.6	<b>W</b> .
		Hand													
		Grenad	r			166.5	107.8			106.9	106.1			163.4	101 7
10		Simulate		133.8	-13.4	86.1	75.6	131.6	-13.4	76.6	71.9	130.6	-12.4	117.2	•
		Hand													
		Grend				106.5	105.6			106.4	105.6			101.3	99.5
11		Simulate		132.4	-13.4	80.3	74.9	132.3	-15.4	74.4	70.7	129.1	-12.4		117.2
		Hund													
		Greand				100.5	107.8			197.1	106.5			101.9	100 4
12		Simulate		134.5	-13.4	82.7	75.8	1女.5	-13.4	63.2	76.4	129.7	-12.4	117.2	•
															APRIL OI
		4				5				6				7	
Preside	_	PARL	CHEL	Post	_	PREL	CEEL					-			~~~
	(Sec)	Noise	Noise	(Flbs)	(Bec)	Noise	Neige	Penk (Flat)	(Auc)	PSEL Note:	CBEL/ Noise	Penk (Flat)	(Sec)	PBEL/ Note:	CHEL
	,,			\ <del></del>				/		1		(a and	,		
		190.6	125.8			191.2	130.9			130.6	128.5			124.3	
159.5	-12.7	104.5	91.6	154.7	-12.7	95.5	95.4	153.8	-12 4	蚁.0	89.6	147.4	-11.3	94 6	
		151.7	129.5			151.5	1 <b>29</b> . i			130.4	126.2			123.4	
154.8	-12.7	101.3	96.7	154.7	-12.7	99.5	94.7	155.4	-12.7	99.7	96.4	148.5	-12.1	94.9	
		115.4	112.7			111.0	110.2			110.0	100 1				
137.9	-12.7	97.3	95.3	136.4	-12.9	94.6	95.0	134.5	-12.7	94.3	91 4	131.3	-13.0	367.4 92.6	
					- 14.5			134.3	-14.7			101.3			
104.4	-13 7	116.5 94.1	115.1 <b>68</b> .5	136.7	-12.9	116.7 98.8	110.5			J <b>60</b> .5	100.1			106.8	
130.0	-13 /			130.7	-12.9		87.1	132.9	-12.7	98.4	<b>86.3</b>	190.3	-13.0	78.1	
		10E.6	101 9			104.9	165.6			100.1	100.7			96.9	
129.1	-13.7	71.6	70.6	131.3	-12.9	7R.5	77.6	120.0	-12.7	<b>30.5</b>	77.4	122.1	-13.0	77.9	
		111.1	104.7			112.5	111.5			110.5	100.4			107.0	
197 &					-17 4	<b>84.3</b>	#4.4	133.5	-12.7	<b>35.5</b>	75.9	191 1	-13.0	70.3	
131.0	-13.7		•	137 H	- 18.5										
131.5	-15.7	119.5	198.0	137 A	- 14.5	110.9	110.1			167.A	100.7			104,8	
	-15.7 -15.7				-12.0		110.1 76.2	132.9	-12.7	167.A 81.3	100.7 77.2	129.1	-12.0	106.8 76.3	
		119.5	146.0			110.9		132.9	-12.7			129.1	-120		
196.2		119.5 80.5	166.8	f\$6.0		110.9 66.6	76.2	132.9		81.3	77.2	129.1 146.4		74.3	
196.2	-15.7	119.5 80.5 130.8	HB.8	f\$6.0	-12.0	110.9 86.6 130.7 96.2	76.2 136.4 97.9			81.3 190.2 100.0	77.2 138.2 98.3			76.5 189.0 92.4	
196.2 158.8	-15.7	119.5 80.5 130.8	166.8	f96.6 156.6	-12.0	110.9 66.6 130.7 96.2 181.2	76.2 136.4 97.9 136.9	<b>!</b> " .	-12.7	81.3 180.2 100.0 180.7	77.2 138.2 98.3 127.5	148.4	-11.9	76.5 185.0 92.4 186.3	
196.2 158.8	-13.7 -13.7	119.5 80.5 120.8	195.8 - - - 192.1	f96.6 156.6	-12.9 -12.9	110.9 86.6 130.7 96.2	76.2 136.4 97.9	<b>!</b> " .		81.3 190.2 100.0	77.2 138.2 98.3		-11.9	76.5 189.0 92.4	
196.2 158.8	-13.7 -13.7	119.5 98.5 128.8 •	122.1	f96.6 156.6	-12.9 -12.9	110.9 60.6 130.7 90.2 101.2 90.4	76.2 138.4 97.9 138.9 94.4	<b>!</b> " .	-12.7	81.3 150.2 160.0 120.7 90.6	77.2 186.2 98.3 197.3 96.2	148.4	-11.9	76.5 186.0 92.4 186.3 96.3	
196.2 158.8 194.7	-13.7 -13.7 -13.7	119.5 00.5 120.0	182.1 191.6	(96.6 (96.6 (94.5	-12.9 -12.9	110.9 66.6 139.7 99.2 191.2 99.4	76.2 136.4 97.9 136.9 91.4	1" . 190.7	-12.7 -12.7	81.3 199.2 169.0 129.7 99.6	77.2 188.2 98.3 187.3 98.2	148.1	-11.9 -11.9	74.3 195.0 92.4 185.3 98.3	
196.2 158.8 194.7	-13.7 -13.7	119.5 98.5 128.8 •	122.1	(96.6 (96.6 (94.5	-12.9 -12.9	110.9 60.6 130.7 90.2 101.2 90.4	76.2 138.4 97.9 138.9 94.4	1" . 190.7	-12.7	81.3 150.2 160.0 120.7 90.6	77.2 186.2 98.3 197.3 96.2	148.4	-11.9 -11.9	76.5 186.0 92.4 186.3 96.3	
196.2 158.8 194.7	-13.7 -13.7 -13.7	119.5 00.5 130.0 120.2	182.1 182.1 101.6 117.6	(96.6 (96.6 (94.5	-12.9 -12.9	110.9 65.6 150.7 90.2 161.2 90.4 160.6 77.6	76.2 136.4 97.9 136.9 91.4 166.1 66.2	1" . 190.7	-12.7 -12.7	81.3 150.2 160.0 150.7 90.6 110.4 74.1	77.2 186.2 96.3 187.5 96.2	148.1	-11.9 -11.9	76.3 189.0 92.4 189.3 90.3 101.4 66.9	
196.2 156.8 194.7	-13.7 -13.7 -13.7	119.5 00.5 120.0	101.6 117.0	196.6 196.6 194.5	-12.9 -12.9 -12.9	110.9 06.6 130.7 90.2 101.2 90.4 100.6 77.8	76.2 136.4 97.9 126.9 91.4 166.1 96.2	17 - 190.7 155.2	-12.7 -12.7 -12.7	81.3 150.2 160.0 120.7 90.6 110.4 74.1	77.2 188.2 98.3 187.5 98.2 168.9	148.4 148.3 186.8	-11.9 -11.9 -18.1	76.3 156.0 92.4 186.3 90.3 101.4 66.9	
196.2 156.8 194.7	-13.7 -13.7 -13.7 -13.7	119.5 00.5 130.0 120.2 100.6 117.6	182.1 182.1 101.6 117.6	196.6 196.6 194.5	-12.9 -12.9	110.9 65.6 150.7 90.2 161.2 90.4 160.6 77.6	76.2 136.4 97.9 136.9 91.4 166.1 66.2	17 - 190.7 155.2	-12.7 -12.7	81.3 150.2 160.0 150.7 90.6 110.4 74.1	77.2 186.2 96.3 187.5 96.2	148.1	-11.9 -11.9 -18.1	76.3 189.0 92.4 189.3 90.3 101.4 66.9	
196.2 156.8 194.7	-13.7 -13.7 -13.7 -13.7	119.5 60.5 130.6 130.2 100.6 117.6	100.8 100.5 117.6 107.6	196.6 196.6 194.5	-12.9 -12.9 -12.9	110.9 60.6 130.7 60.2 151.2 60.4 160.4 77.6	76.2 (36.4 97.9 136.9 94.4 166.1 66.2 166.7 78.9	17 - 190.7 155.2	-12.7 -12.7 -12.7	81.3 190.2 160.0 120.7 90.6 710.4 74.1	77.2 196.2 96.3 197.3 96.2 190.9	148.4 148.3 186.8	-11.9 -11.9 -18.1	76.5 185.0 18.4 186.3 186.3 186.4 186.9 186.7 78.8	
196.2 158.8 194.7 191.8	-13.7 -13.7 -13.7 -13.7	119.5 00.5 130.0 120.2 100.6 117.6	101.6 117.0	196.0 196.0 194.3 194.1	-12.9 -12.9 -12.9	110.9 06.6 130.7 90.2 101.2 90.4 100.6 77.8	76.2 136.4 97.9 126.9 91.4 166.1 96.2	17 - 190.7 155.2	-12.7 -12.7 -12.7	81.3 150.2 160.0 120.7 90.6 110.4 74.1	77.2 188.2 98.3 187.5 98.2 168.9	148.4 148.3 186.8	-11.9 -11.9 -12.1	76.3 156.0 92.4 186.3 90.3 101.4 66.9	

			<u> </u>				1					
Weepee	Peak (Flat)	dB (Sec)	PSEL/ Noise	CSEL/ Noise	Peak (Plat)	dill (Sec)	POEL/ Notes	CSUL/ Noise	Peak (Flat)	dB (Sec)	POEL/ Noise	CEEL
												<b>142.7</b>
Simulator	132.6	-13.4	<b>86.1</b>	76.2	130.6	-15.4	79.6	70.9	131.9	-12.4	117.2	117.2
Hund												
Grenade			165.8	104.5			165.8	104.7			104.4	icz.9
Simulation	139.2	-15.4	84.4	75.2	130.5	-15.4	75.7	74.6	132.4	-12.4	117.2	117.2
			129.9	127.3			128.7	125.9			122.6	121.5
CH	152.8	-13.4	103.7	100.4	151.0	-15.4	100.1	98.3	146.2	-12.4	•	•
Artificay												
Florin			100.8	99.0			99.7	97.9				92.5
Semulator	126.0	-13.4	#6.4	<b>80.8</b>	124.9	-15.4	85.3	78.2	119.2	-12.1	•	•
Artillery												
Flanh			110.6	109.9			110.5	109.5			109.7	107.9
Simulator	136.3	-13.8	81.3	68.5	135.9	-13.4	78.6	76.1	136.9	-12.4	•	•
Artillery												
Flooh			186.8	117.8			106.4	194.5				99.6
Semulator	150.5	-11.9	78.7	75.8	129.9	-12.1	76.1	74.8	127.6	-12.4		
C-4												
			129.6	126.9			129.9	127.6			1242	122.9
C-4	152.2	-11.9	197.5	105.0	155.2	-12.1	100.2	99.4	150.2	-12.4		•
	Hand Grenade Simulator Hand Grenade Simulator C-3 Artiflery Flash Simulator Artiflery Flash Simulator Artiflery Flash Simulator C-4	Weepon (Flot) Hand Geenade Simulator 132.6 Hand Grenade Simulatus 130.2  C-4 152.8 Artiflery Floth Simulator 126.0 Artiflery Floth Simulator 136.3 Artiflery Floth Simulator 136.3 C-4	Weepen (Plat) (Sec)  Hand Grenade Simulator 132.6 -13.4  Hand Grenade Simulator 130.2 -13.4  C-4 152.8 -13.4  Artiflery Flash Simulator 126.0 -13.4  Artiflery Flash Simulator 136.3 -13.8  Artiflery Flash Simulator 130.5 -11.9  C-4	Hand   Grenade   106.5   Simulator   132.6   -13.4   38.1   Hand   Grenade   105.8   105.8   105.8   105.8   105.8   105.8   105.8   105.7   105.7   105.7   105.7   105.7   105.7   105.7   105.8	Peak dB   PBEL   CBEL     Weapen (Plat) (flet)   Noise   Noise     Hand   Grenade   105.5   106.5     Simulator   132.6   -13.4   20.1   76.2     Hand   Grenade   105.8   104.5     Simulator   130.2   -13.4   24.4   75.2     C-4   152.8   -13.4   105.7   100.4     Artiflery   Flash   100.8   99.0     Simulator   126.0   -15.4   20.1     Simulator   136.3   -13.8   20.3     Artiflery   Flash   106.5   109.9     Simulator   136.5   -13.8   20.5     Simulator   136.5   -13.8   20.5     C-4   129.6   126.9	Peak   dB   PREL   CREA   Peak   Pe	Peak dB   PBEL   CBEL   Peak dB   Peak dB   Peak   Peak dB   Peak	Peak dB	Peak dB	Peak   dB   PBEL   CBEL   Peak   dB   PBEL   CBEL   Peak   CBEL   Peak   Peak   PBEL   CBEL   Peak   Peak   PBEL   CBEL   Peak   Peak   PBEL   CBEL   PBEL   PBEL	Peak   dB   PREL   CREA   Peak   dB   PREL   CREA   Peak   dB   PREL   CREA   Peak   dB   Precede   Peak   Peak   Peak   Peak   Peak   Peak   dB   Precede   Peak   Peak   Peak   Peak   Peak   Peak   Peak   dB   Precede   Peak   Peak	Peak   dB   PBEL   CBEL   Peak   dB   PBEL   CBEL   Peak   dB   PBEL   CBEL   Peak   dB   PBEL   CBEL   Peak   dB   PBEL   CBER   Peak   dB   PBEL   CBER   Peak   dB   PBEL   Peak   dB   PBEL   Peak   dB   PBEL   PEAK   PEAK   PBEL   PBEL

		4				5				•				DATE:	2 APRIL 61
Poul (Flat)	46 (Bec)	PREL/ Note:	CSRL/ Noise	Pook (Flat)	(Sec)	PREL/ Noise	CSRL/ Noise	Peak (Flat)	di (Bec)	Page / Noise	CSEL/ Noise	Peak (Flat)	dill (Sec)	PREL. Noise	CSEL. Note:
		106.4	100.9			110.6	100.9			100.4	107.7			105.0	103.0
136.6	-13.7	•	٠	196.1	-13.0	78.0	77.2	135.6	-12.7	67.5	71.#	128.5	-12.3	74.6	70.0
		105 6	99.6			160.0	166.4			100.1	167.2			102.1	101.5
192.8	-13.7	•	•	134.0	-13.0	#5.2	73.9	132.4	-12.7	91.1	<b>69.6</b>	126.6	-12.3	63.3	71.2
		127.6	120.6			120.9	135.6			129.7	127.5			124.1	121.3
150.0	-13.7	-	•	154.1	-13.0	96.9	94.3	192.9	-12.7	99.5	96.7	1 96.7	-12.3	92.2	80.5
		96.7	85.9			101.7	100.4			101.4	100.2			95.4	25.6
125.1	-13.7	•	•	127.5	-15.0	82.1	76.0	126.6	-12.7	04.3	76.9	120.2	-123	76.7	72.9
		160.8	104.6			112.0	•			111.6	110.9			106.3	104.7
157.0	-18.7	•	•	197.2	-13.0	•	•	136.6	-127	70.2	00.0	130.0	-12.3	71.8	68.1
		101.4	90.7			107.4	106.3			106.7	105.3			101.0	100.1
192.5	-18.7	•	•	130.0	-13.0	82.3	74.3	130.6	-12.7	61.4	77.3	124.9	-12.9	76.4	72.5
						131.0	120.7			159.6	127.5			124.5	A.ISI
				154.9	-12.0	71.3	97.9	196.2	-12.7	168.7	97.4	147.7	-11.6	90.3	12.0

Station:													
				1				<u>.</u>				5	
Event	Weepon	Peak (Flat)	48 (Rec)	PSEL/ Noise	CSEL/ Notes	Peak (Fint)	dB (Bac)	POEL/ Notes	Cast./ Natar	Peak (Plat)	d& (Sec)	PSEL/ Note:	Catt.
21	C-4	154 (	-12.6	131.5 105.7	1 <b>06.5</b>	150 0	-13.2	1 <b>30.</b> 4 101.6	· .			190.5	(54.3
••	٠.	151.1	-12.0			150.2	-19.2		99.1	130.2	-12.7	99.8	<b>9.7</b>
22	C-4	154.2	-12.6	131.5 1 <b>06.9</b>	129.2 101.5	153.6	-13.2	1 <b>30</b> .6 1 <b>00</b> .5	188.5 98.7	155.6	-12.6	130.5 103.6	139.2 99.7
				105.5	102.5			107.9	106.7			120.5	119.6
23	WA.I	129.1	-126	90.5	<b>08.6</b>	135.5	-12.6	81.1	78.6	144.2	-12.#	81.2	79.4
21	LAW	129.5	-12.6	101.5 91.2	103.8 86.9	152.0	-12.8	196.5	105.5 78.1	142.5	-15.1	118.5 86.2	117.5 #1.2
				104.5	103.5			106.9	105.4			116.2	117.5
25	LAW	151.6	-12.6	90.7	88.4	133.4	-12.8	82.2	79.8	141.9	-13.1	81.6	79.0
				129.3	128.9			130.2	127.8			156.5	(26.0
26	C-4	154.1	-12.6	104.4	105.9	155.1	-12.8	195.3	99.2	152.9	-13.1	99.1	96.1
				131.1	128.7			130.1	127.8			130.3	129.1
27	C-4	153.9	-126	105.8	103.8	153.1	-12.8	100.9	98.7	152.7	-15.1	102.2	96.7
				165.4	104.7			106.7	165.7			116.5	115.6
20	LAW	130.6	-12.6	90.4	<b>84.</b> 5	132.9	-12.8	20.9	20.0	146.1	-15.1	63.7	<b>25</b> . 1
29	LAW												
				104.8	105.7			106.9	105.8			1169	115.8
30	LAW	130.2	-12.6	<b>89.2</b>	<b>87.</b> Ł	132.9	-12.5	81.}	77.8	139.1	-15.1	95.1	<b>30</b> .5
31	C-1	159.0	-126	131.1 105.7	126.8	158.9	-12.8	130.1 99.6	127.7 97.1	150 7	-13.1	150.0 100.2	127.8 95.8
	<b>3</b> ,	1,74.7		131.3			-14.0			136.7	-13.1		
52	C-1	154.3	-12.6	197.4	129.2 104.2	152.9	-12.8	130.1 100.4	127.6 97.6	151.8	-13.1	129.4 101.8	127.1 98.2

		4				5				6				DATE:	S APRIL 61
Penk (Fint)	dB (Sec)	PEEL/ Noise	CSEL/ Noine	Peak (Flat)	dB (Sec)	PSEL/ Noise	CBEL/ Notes	Peak (Fint)	dB (Sec)	PREL/ Noise	CSEL/ Noise	Penk (Flat)	dB (Sec)	PERL/ Noise	CIEL/ Noise
		150.9	128.5			151.1	198.2			190.2	134.1			199.2	131.6
133.0	-12.6	103.2	100.3	139.9	-12.4	102.2	96.4	153.1	-12.2	97.6	96.1	152.5	-12.8	105.9	102.4
		130.6	128.0			191.5	132.8			130.4	120.1			129.7	126.6
153.2	-12.6	101.6	198.5	154.1	-12.4	101.5	97.5	153.5	-12.2	105.1	102.1	151.7	-12.8	195.9	101.9
		121.7	120.7			116.1	115.1			100.9	94.4			115.4	114.5
144.4	-12.6	91.2	86.9	140.6	-12.4	•	71.9	130.5	-12.2	100.1	82.5	137.3	-128	77.6	76.0
		122.6	121.5			119.3	118.3			106.9	106.9			116.3	115.2
145.1	-12.6	90.7	89.4	143.6	-12.4	•		132.5	-12.2	84.8	82.7	136.1	-12.6	61.1	76.9
		122.3	121.3			119.4	118.4			107.0	106.2			116.1	115.1
145.9	-12.6	91.2	<b>10.7</b>	143.6	-12.4	70.2	•	192.1	-12.2	04.5	<b>EL</b> 7	187.9	-12.8	77.7	70.9
		130.1	127.6			130.5	127.9			130.6	130.4			129.6	126.6
152.8	-12.6	165.1	102.5	154.0	-12.4	87.9	91.7	155.6	-12.2	106.1	104.6	151.7	-12.0	106.1	102.2
		129.9	127.5			151.1	120.7			130.4	120.3			120.9	127.4
192.4	-12.6	102.3	160.7	156.8	-12.4	96.0	95.3	150.5	-12.2	100.1	101.4	151.7	-12.0	102.8	100.2
						1 19.3	110.3			107.6	100.7			114.7	115.5
				143.3	-12.4	<b>97.</b> 1	86.3	192.4	-12.2	88.3	80.2	197.0	-12.6	76.9	71.1
						119.2	116.2			106.5	105.6			113.0	113.6
				143.0	-12.7	99.2	86.1	181.3	-12.2	86.4	61.7	196.6	-12.0	77.4	76.0
		120.9	126.7			151.6	120.4			120.5	199.4			199.5	196.7
150.0	-12.6	100.2	99.8	194.7	-12.7	101.6	95.1	196.9	-12.2	100.5	93.0	101.7	-12.0	100.6	146.2
						181.4	188.1			191.5	100.5			100.5	186.6
				194.3	-127	102.3	94.5	104.9	-12.2	100.5	4.10	190.7	-12.6	101.7	100.0

# APPENDIX D: DATA REDUCTION TABLES

The C-4 blasts just before and just after each weapon event or series of events were averaged to form a correction value that would convert the C-4 to a perfect hemispherical source. Each weapon was then averaged by station and

subtracted from this correction value to give the corrected values for each weapon at each station. These values were then normalized to the 180° position and used to form the entires for the BNOISE 5.2 program.

Table Di Reduced Data — LAW

Timesugh 4	C-4 Energy Averages					
(Rew C-4 Values) (Raw Value) Correction Corrected Value 5 % of C-4  129.9 108.5 +.9 184.2 -25.6  129.0 105.8 +1.8 197.6 -22.2  130.6 118.58 117.5 -12.5  127.9 121.5 +1.9 123.2 -4.6  131.1 117.5 -12.5 116.0 -13.6  131.1 117.5 -1.5 116.0 -13.6  130.6 106.8 -1.5 116.0 -23.8  130.6 106.88 106.0 -23.8  2 Through 6 (Raw Value) Correction Corrected Value 5 % of C-4  129.9 104.26 166.6 -24.7  127.8 105.8 -5 166.3 -22.0  127.8 105.8 -5 166.3 -22.0  127.8 115.7 +5 116.2 -12.1  127.8 115.7 +5 116.2 -12.1  127.8 106.24 106.8 -22.5  127.8 106.24 106.8 -22.5  128.7 106.24 106.8 -22.5  Average LAW Data Re: 5 % of C-4 (corrected to be symmetrical)  Average LAW Data Re: -6 0.0 (1897) -3.6 (1897) -3.6 (1897) -3.6 (1897) -3.6 (1897) -3.6 (19		First LAW Set				Value Ber
128.0 105.8 +1.8 107.6 -22.2 130.6 118.38 137.5 -12.3 137.9 121.3 +1.9 125.2 -4.6 131.3 131.3 117.5 -1.5 116.0 -15.8 130.6 105.88 106.0 -23.8 129.8 129.8 105.88 106.0 -23.8 106.0 -23.8 129.8 105.88 106.0 -23.8 106.0 -23.8 129.8 106.0 -23.8 129.8 106.0 -23.8 129.8 106.0 -23.8 129.8 106.0 -23.8 129.8 106.0 -23.8 129.8 106.0 -23.8 129.8 106.0 -23.8 129.8 106.2 -6 168.6 -24.7 127.8 105.8 -5.5 168.5 -22.7 127.8 105.8 -5.5 168.5 -22.0 127.8 115.7 +.5 168.5 -22.0 127.8 115.7 +.5 168.5 -22.0 127.8 115.7 +1.0 128.8 118.35 117.8 -105.8 -22.5 128.8 118.35 117.8 -105.8 -22.5 128.8 118.55 106.24 105.8 -22.5 128.5 106.24 105.8 -22.5 128.5 106.24 106.24 106.0 106.			C	errection	Corrected Value	
190.6	128.9	105.5		+.9	194.2	-25.6
127.9 121.3 +1.9 123.2 -4.6 131.3 117.5 -1.5 116.0 -13.8 130.6 106.8 -7.8 106.0 -23.6 128.8  C-4 Energy Averages 3 Through 6 Second LAW Set Value Ret (Raw C-4 Values) (Raw Value) Correction Corrected Value 5 th of C-4 128.9 104.26 106.5 -22.7 127.8 105.5 +.5 106.3 -22.0 127.8 115.7 +.5 116.2 -12.1 127.8 116.55 116.2 -12.1 128.8 118.55 116.2 -12.1 128.8 118.55 117.8 -105.3 128.7 106.24 106.8 -22.5  Average LAW Data Ret 5 th of C-4 (corrected to be symmetrical) to Rear + 6.6 db  -25.1 -25.1 -25.1 -18.5 (0°) -25.1 -22.6 -16.6 (0°) -11.8 -12.9 -5.4 (10°) -11.8 -12.9 -5.4 (10°) -12.9 -5.4 (10°) -12.1 -12.2 -12.6 -16.6 (10°) -12.2 -12.6 -16.6 (10°) -12.6 -11.7 -12.9 -5.4 (10°) -12.7 -12.2 -12.6 -16.6 (10°) -12.6 -16.6 (10°) -12.7 -	128.0	105.8		+1.8	167.6	-22.2
151.3 117.5 -1.5 116.0 -15.8 190.6 106.8 106.88 190.6 -23.6 129.8 106.88 190.6 -23.6 129.8 106.88 190.6 -23.6 129.8 106.88 190.6 -23.6 129.8 129.8 106.88 190.6 106.823.6 129.8 128.9 104.26 186.6 -24.7 127.8 105.85 106.3 -22.0 127.8 115.7 +.5 116.2 -12.1 127.5 128.8 115.75 116.2 -12.1 128.8 116.55 116.2 -12.1 128.8 116.55 117.8 -10.5 128.7 106.24 106.822.5 128.5 106.24 106.822.5 128.5 106.24 106.822.5 128.5 106.24 106.822.5 128.5 106.24 106.822.5 128.5 106.24 106.8 10.8 10.8 10.8 10.8 10.8 10.8 10.8 10	****	118.5		8	117.5	-12.3
190.6   190.8   -8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.8   190.0   -25.1				+1.9	129.2	-6.6
123.8   C-4 Energy Averages   3 Through 6   Second LAW Set ((Raw Value)   Correction   Corrected Value   5 th of C-4     128.9	131.3	117.5		-1.5	116.0	-13.8
C-4 Energy Averages 3 Through 6 (Raw Value) Correction Corrected Value Ber (Raw C-4 Values) (Raw Value) Correction Corrected Value 5 th of C-4  128.9 104.26 186.624.7 127.8 105.8 +.5 186.522.0 127.8 115.7 +.5 116.212.1 127.3 +1.0 128.8 116.55 117.8 -18.5 128.7 106.24 105.822.5  Average LAW Data Rer 5 th of C-4 (corrected to be symmetrical) of C-4 with 0 ds of C-4 with 0 ds of C-4 with 0 ds of C-4 -18.5 (8°)  -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -25.122.6 -18.0 (80°) -27.627.6 -18.0 (80°) -27.627.6 -18.0 (80°) -27.627.6 -18.0 (80°) -27.627.6 -18.0 (80°) -27.7 (-8.0)	130.6	106.8		<b>8</b>	106.0	-23.8
S Through 6 (Raw Value)   Correction   Corrected Value   S B of Cd     128.9	129.8					
(Rave C-4 Values) (Rave Value) Correction Corrected Value S B of C-4    128.9	C-4 Energy Averages					
128.9   104.2  6   108.6   -24.7   127.8   105.8   +.5   106.5   -22.0   127.8   115.7   +.5   116.2   -12.1   127.5   116.2   -12.1   127.5   128.8   118.3  5   117.8   -10.5   128.7   106.2  4   105.8   -22.5   128.7   128.3   128.5   128.7   106.2  4   105.8   -22.5   128.5   128.7   128.7   128.5   128.5   128.7   128.5   128.5		Second LAW Set				Value Re:
127.8 105.8 +.5 106.322.0 127.8 115.7 +.5 116.2 -12.1 127.5 +1.0 122.8 116.35 117.8 -10.5 122.7 106.24 106.822.5  Average LAW Data Re: Average LAW Data Re: 5 th of C-4 (corrected to be symmetrical)  -25.1 -25.1 -25.1 -16.0 (09°) -22.1 -22.6 -16.0 (00°) -4.6 -4.6 0.0 (100°) -11.8 -12.0 -5.4 (120°) -25.1 -22.6 -16.0 (100°) -25.1 -25.1 -25.6 -16.0 (100°) -25.1 -25.1 -25.6 -16.0 (100°) -25.1 -25.1 -25.6 -25.6 -25.6 (100°) -25.1 -25.1 -25.6 -25.6 -25.6 (100°) -25.1 -25.1 -25.6 -25.6 -25.6 (200°) -26.6 -4.6 0.0 (100°) -27.6 -11.8 -27.6 -16.0 (200°) -27.6 -16.0 200° (-1.0) 00° (-16.0) 200° (-1.0) 00° (-16.0) 200° (-1.0) 00° (-16.0) 200° (-1.0)	(Raw C-4 Values)	(Raw Value)	C	errection	Corrected Value	5 B of C-4
127.8 115.7 +.5 116.2 -12.1 127.3 +1.0 116.2 -12.1 127.3 +1.0 1128.8 118.55 117.8 -10.5 128.7 106.24 106.24 105.8 -22.5 128.3				6	145.6	-24.7
127.5 128.8 118.3 128.7 106.2 106.2 106.2 106.2 117.8 117.8 105.8 117.8 105.8 127.5 128.5  Average LAW Data Re: 5 th of C-4 (corrected to be symmetrical)  -25.1 -	127.8	105.8	•••		106.3	-22.0
128.8   118.3  5   117.8   -10.5   128.7   128.5   106.2  4   105.8   -22.5   128.5   128.5   128.5   106.2  4   105.8   -22.5   128.5   128.5   106.2  4   105.8   -22.5   128.5   106.2  4   106.2	127.8	115.7		+.5	116.2	-12.1
128.7   106.2  4   105.8   -22.5	127.3			+1.0		
Average LAW Data Re:   Average LAW Data Re: 5 th of C-4   of C-4 with 0 dB   of Re-4 with 0 dB   of Re-4 with 0 dB   of Re-7 6.6 dB    -25.1	129.8	118.3		5	117.8	-10.5
Average LAW Buts Re: Average LAW Buts Re: 5 th of C-4 of C-4 with 0 dB to Res * 6.5 dB  5 th of C-4 (corrected to be symmetrical)  -25.1 -25.1 -18.5 (0°)  -22.1 -22.6 -16.0 (00°)  -12.2 -12.0 -5.4 (120°)  -6.6 -6.6 -0.0 (100°)  -11.8 -12.0 -5.4 (200°)  -25.1 -22.6 -16.0 (300°)  -12.2 -5.6 -16.0 (300°)  -12.2 -5.6 -16.0 (300°)  -12.2 -5.6 -16.0 (300°)  -15.6 -16.0 (300°)  -16.0 (300°)  -16.0 (300°)  -16.0 (300°)  -17.1 (1.0)  -17.1	128.7	106.2		n.4	105.8	-22.5
Average LAW Data Re:  5 th of C-4  -25.1  -25.1  -25.1  -22.1  -22.6  -12.2  -3.4 (139°)  -4.6  -11.8  -12.9  -25.1  -22.6  -11.8  -12.9  -25.1  -25.6  -11.8  -12.9  -25.6  -11.8  -12.9  -3.4 (240°)  -3.6  -15.2   Valence for Table 8 (BNOME 3.2 Input State)   F (-18.5)  100° (-18.6)  90° (-18.6)  90° (-18.6)  100° (-18.6)  90° (-18.6)  100° (-18.6)	128.5					
18.5   18.5					Average I	LAW Does Bet 5 lb
-25.1 -22.6 -16.0 (00°) -12.2 -12.0 -5.4 (120°) -4.6 -4.6 -4.6 -0.0 (100°) -11.8 -12.0 -5.4 (200°) -23.1 -22.6 -16.0 (300°) -12.2 -5.6  Values for Table 5 (BNOSE 3.2 layer Sum)  0° (-18.5) 100° (-1.0) -5.6  Value for Table 5 (BNOSE 3.2 layer Sum)  0° (-18.5) 210° (-1.0) -5.6						
-22.1 -22.6 -16.0 (00°) -12.2 -12.0 -5.4 (130°) -4.6 -4.6 -0.0 (180°) -11.8 -12.0 -5.4 (200°) -22.6 -16.0 (300°) -12.2 -3.6  Values for Table 8 (\$100002 2.2 Imper Sum)  0° (-18.5) 100° (-1.0) 00° (-16.0) 200° (-1.0) 00° (-16.0) 200° (-1.0) 120° (-2.0) 120° (-2.0) 120° (-3.4) 500° (16.0)	3 m et C-4		(corrected to I	e symmetrical)	to II	lear + 6.5 dB
-12.2 -12.6 -5.4 (139°) -4.6 -4.6 -0.0 (109°) -11.8 -12.0 -5.4 (200°) -22.6 -16.0 (300°) -12.2 -3.6  Values for Table 8 (\$100000 2.2 Imper State)  0° (-18.5) 100° (-0.0) 30° (-17.1) 210° (-0.0) 90° (-0.0) 200° (-0.4) 90° (-0.0) 200° (-0.0) 120° (-0.0) 300° (16.0)			_		-1	8.5 ( <b>6"</b> )
-4.6 -4.6 -4.6 -4.6 -4.6 -4.6 -4.6 -4.6	<del></del> -		_		-1	iù 0 (00°)
-11.6 -12.0 -5.4 (200°) -23.1 -22.6 -16.0 (300°) -12.2 -3.6  Values for Table 8 (BNOSSE 3.2 layer State)  0° (-18.5) 100° (-0.0) 30° (-17.1) 210° (-1.0) 00° (-16.0) 200° (-3.4) 30° (-6.0) 120° (-3.4) 30° (-5.4) 300° (16.0)				<b></b>	•	-5.4 (1 <b>26°</b> )
-23.1 -22.6 -16.0 (300°) -12.2 -3.6  Values for Table 8 (BNOSSE 3.2 layer Store)  0° (-18.5) 100° (-1.0) 30° (-17.1) 210° (-1.0) 40° (-16.0) 200° (-3.4) 50° (-3.4) 500° (-3.4)						
-12.2 -3.6  Values for Table 8 (BNORSE 3.2 Japan Store)  O' (-18.5)	****		_			
Values for Table 8 (BNOSSE 2.2 Imper Burn)  0° (-18.5) 180° (-0.0)  30° (-17.1) 210° (-1.0)  00° (-16.0) 200° (-0.4)  90° (-0.0) 270° (-0.0)  130° (-5.4) 500° (16.0)	-25.1			2.6	-	(6.0 (300°)
0° (-18.5) 180° (-8.0) 30° (-17.1) 210° (-1.9) 60° (-16.0) 200° (-8.4) 90° (-8.0) 270° (-8.0) 130° (-5.4) 300° (16.0)			-1	22	•	-5.6
30° (-17.1) 210° (-1.0) 00° (-16.0) 200° (-0.4) 90° (-0.0) 270° (-0.0) 130° (-5.4) 500° (16.0)		Val	me for Table 5 (BI	4000E 1.2 Input Bom)		
30° (-17.1) 210° (-1.0) 40° (-16.0) 240° (-8.4) 50° (-8.0) 270° (-8.0) 130° (-5.4) 300° (16.0)			<b>₽</b> (~19.5)	1000 / 8.00		
60° (-16.6) 200° (-8.4) 90° (-8.0) 270° (-8.0) 130° (-5.4) 500° (16.0)						
90° (-0.0) 270° (-0.0) 130° (-5.4) 500° (16.0)			• • •			
130" (-5.4) 300" (16.0)						
, ,				•		
			156° (-1.9)	300° (-17.1)		

Table D2 Reduced Data — TOW

Plest and Second C-4 Energy Averages (Raw C-4 Values)	First TOW Set (Raw Value)	Correction	Corrected Value	Value Re: 5 lb of C-4
124.1	_	+1.7	_	_
125.1	96.0	+2.7	98.7	-27.1
125.4	111.7	+.4	112.1	-13.7
122.2	114.2	+3.6	117.8	-8.0
128.0	117.7	-2.2	115.5	-10.3
128.2	101.3	-2.4	98.9	-26.9
125.8				

Second and Third C-4 Energy Averages (Raw C-4 Values)	Second TOW Set (Raw Value)	Correction	Corrected Value	Value Re: 5 Ib of C-4
124.3	121.0	+1.5	122.5	-3.3
122.9	97.9	+2.9	190.8	-25.0
124.6	110.9	+1.2	112.1	-13.7
122.6	<del></del>	+3.2	-	· -
128.1	118,4	-2.5	116.1	<del>-9</del> .7
128.3	102.1	-2.5	99.6	-26.2
125.8				

Average TOW Data Re: 5 H of C-4 (dB)	Average TOW Data  Re: 5 lb of C-4 (dB)  (corrected to be symmetrical (dB))	Adjusted Average TOW Data Re: 5 lb of C-4 with 6 db to Rear + 8.0 dB
-3.3 °(-30.0)	-30.0	-22.0 ( <b>0°</b> )
-25.9	-26.2	-18.2 (60°)
-13.7	-11.5	-3.5 (120°)
-8.0	<b>-8.0</b>	0.0 (180°)
-10.0	-11.5	-3.5 (240°)
-26.5	<u>-26.2</u>	-18.2 (300°)
	-12.9	-1.9

# Values for Table 3 (BNOSSE 5.2 Impot Data)

0° (-22.0)	188° ( 0.0)
30° (-19.7)	210° (-1.4)
60° (-18.2)	240" (-3.5)
90° (-6.4)	270" (-6.4)
120° (-3.5)	300° (18.2)
150° (-1.4)	590° (-19.7)

A = -12.9 + 119 = 106.1 B = 0 Average = -4.9 °-3.5 (dB) is more a measure of the rocket passing near the microphone than a measure of the weapon firing noise. Hence, it is excluded from further calculation and replaced by -30.0 (dB) since the LAW data show the front to be the quickest position.

Table D8

Reduced Data — Artillery Signulator

C-4 Energy Averages 1 Through 4 (Raw C-4 Value)	Sim	t Artillery wlater Set w Value)	Correction	Corrected Value
127.0		107.0	+.4	107.4
126.0		111.9	+1.4	115.3
127.4		112.5	0.0	112.3
126.8		110.6	+.6	111.2
128.8		109.9	-1.4	108.5
128.1		107.8	7	107.1
127.4				110.6
Corrected Average	110.6			
C-4 Average	-127.4			
	-16.8 -5.0°	Value re: 1-1/4 lb	of C-4	
	-21.8	Value re: 5 lb of	C4	

A = -21.8 + 119 = 97.2 = Value for Table 3 (BNOISE 5.2 Input Data)

\*The -5.0 dB shift from Figure 17 of CERL TR N-98 plus the 119 dB converts the data to re: 5 lb of C-4 set off on the ground at 250 m.

Table D4

Reduced Data — Artillery Flash Simulator

First and Second C-4 Energy Averages		ery Flash Mator Set		
(Raw C-4 Value)	(Rav	v Value)	Correction	Corrected Value
127.1	1	13.7	+1.2	114,9
126.8	1	106.1	+1.5	107.6
122.5	i	03.8	+6.0	109,8
120.8	1	100.9	+7.5	10N.4
133.4		104.3	-5.1	99.2
127.5		107.1	+0.7	107.R
128.3				110.0
Corrected Average	110.0			
C-4 Average	128.5			
	-18.5	Value re: 1-1/4 lb of (	24	
	-5.00			
	-23.3	Value re: 5 lb of C-4		

A = -23.5 + 119 = 95.7 = Value for Table 3 (BNOSSE 3.2 Input Data)

"The -5.0 dB shift from Figure 17 of CERL TR N-96 plus the 119 dB converts the data to re: 5 lb of C-4 set off on the ground at 250 m.

Table D5

Reduced Data — Hand Greande Simulator

C-4 Energy Averages 2 Through 4	Sie	d Grenade wlater Set		
(Raw C-4 Value)	(Ra	rw Value)	Correction	Connected Value
127.1		106.4	<b>+.9</b>	107.3
126.2		105.6	+1.8	107.5
126.3		101.6	+1.7	105.5
121.5		100.6	+6.5	107.1
132.5		106.7	-4.3	104.4
127.7		106.7	٠.5	100.0
128.0				106.0
Corrected Average	106.8			
C-4 \verage	-128.0			
-	-21.3 -5.0°	Value re: 1-1/4 lb of (	A	
	-26.2	Value re: 5 lb of C-4		

A = -26.2 + 119 = 92.8 = Value for Table 3 (BNOISE 5.2 Input Data)

\*The -5.0 dB shift from Figure 17 of CERL TR N-98 plus the 119 dB converts the data to re: 5 lb of C-4 set off on the ground at 250 m.

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